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C1Po1C-03: Parametric thermal characterization of Sumitomo RDE-418D4 two-stage Gifford-McMahon cryocooler

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Cryocoolers are an excellent go-to solutions when cryogen-free dry cooling is essential. The existing cryocoolers in the market are certified with the cooling capacity specified only at generic points (such as 4.2 K, 10 K and 20 K). However, if the cryorefrigeration is to be obtained in any other cryogenic temperature range, the cryocooler capacity is not readily available. It is indeed possible to get a rough estimate from the capacity map supplied with the cryocoolers. Nevertheless, this is a generalized data based on tests conducted on numerous cryocoolers and not specific to the cryocooler unboxed. Our application seeks cryorefrigeration in liquid neon temperature range. For this purpose, the highest capacity 4K cryocooler manufactured by Sumitomo RDE-418D4 has been employed. At second-stage temperature of 4.2 K, the cold head has capacity specifications of 1.8 W @ 50 Hz and 2.0 W @ 60 Hz with first-stage load of 42 W and 50 W respectively. It operates with F-50SH water-cooled helium compressor. This work presents the thermal characterization of the cryocooler second-stage at varying heat loads from 100 mW to 25 W. Different data sets are obtained while maintaining the first stage at no load (0 W) or under constant load conditions (25 W, 50 W, 75 W). Additionally, the cooling capacity is recorded at different compressor frequency of 40 Hz, 50 Hz, 60 Hz and 70 Hz.

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